A

SYNOPSIS

ON

"Studies on management of Alternaria blight and bacterial blight of Mustard"

Submitted to

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"Studies on management of Alternaria blight and bacterial blight of Mustard"

1) INTRODUCTION

The Angiosperm appeared in Cretaceous age about 65 million year back. Charles Darwin described this sudden appearance of Angiosperm in lower and higher Cretaceous as on 'abominable mystery'.

Mustard or rapeseed is Angiospermic dicotyledonous plant belongs to the family Brassicaceae (Cruciferae) and order brassicales (Cruciferales). Family Brassicaceae includes 350 genera and 2500 species.

Brassica compestris L *var. Dichotoma* (kali sarson) as an oil yielding crop mostly cultivated in north India (Punjab). It is *rabi* oil seed crop in India. The seed oil are used as condiment in the preparation of pickles and in cooking, frying processes. The seed oil used as an illuminate and lubricant used in soap and rubber industry. Oil cake is used to cattle feed.

Brassica compestris L. Very largely grown during the cold season. Morphology of mustard plant is as follow,

Habitat: It is annual herb cultivated.

Root: It has branched tap root system.

Stem: Erect, herbaceous, cylindrical, branched, smooth and green.

Leaf: Simple, alternate, sessile, ex-stipulate, unicostate, reticulate venation, upper leave entire and lower leaves lyrate.

Inflorescence: Racemose, typical raceme.

Flower: Pedicellate, ebracteate, hermaphrodite, actinomorphic, yellow, hypogynous, complete, tetramerous, cyclic.

Calyx: Four sepals, polysepalous, arranged in two whorls, inner whorl are longer, aestivation imbractiate.

Corolla: Four Patel, polypetaly, each Patel consist of a limb and claw, cruciform, alternate the sepals, imbricate or valuate aestivation.

Androcium: Six stamen, polyandrous arranged in to whorl, the two stamens of outer whorl or smaller than the inner four stamens. Anther bilobed, basifixed.

Gynoecium: The carpel is bicarpellary, syncarpous, ovary superior, unilocular, but become bilocular because of the development of false septum, parietal placentation, style short, stigma bilobed.

Fruit: Siliqua.

Economic value: The tender leaves and shoot are used as vegetable, seeds are used as a condiment, seed yield oils used in cooking purpose.

The oil content of rapeseed ranges 30-48 percent. Rapeseed is crops of tropical as well as temperate zones. And require somewhat cool and dry weather for satisfactory growth. Rapeseed is long day crop in photoperiodic response. These crops are not draught tolerant. Inter cropping id done with maize, wheat, rice, cabbage, broccoli, coriander.

Mustard affected by various diseases like,

- Alternaria Black Spot- *Alternaria brassicae*
- White rust – *Albigo Candida*
- Downy mildew – *Peronospora parasitica*
- Sclerotina stem rot - *Sclerotina sclerotirum*
- Mustard aphids – *Lipaphis erysimi*
- Panted bug – *Bagarda hilaris*
- Mustard sawfly – *Athalia lugens proxima*.

Mustard is among the oldest recorded species are seen in Sanskrit record dating back to about 3000 BC (Mehra 1968) and was one of the first domesticated crops. Mustard ward was derived from Latin '*mustum'*. Must is the expressed juice of grape or other fruits mixed with ground mustard seed to form *mustum ardens* ('hot or burning must') was a roman speciality condiments. In ayurveda, the Indian medicine as well as Yunani, mustard and it's oil are extensively used (krushnamurthy 1993) seeds are useful in itching skin diseases and disease of viscera and warm infection. Mustard oil is pungent and enhances digestion. Excess use of oil causes impotency in males. It also forms an ingredient in many Ayurvadic medicated oils used as massage in many paralytic diseases of the nervous system.

Some members of Brassicaceae are,

1) *Brassica compestris var. Dichotome* (kali sarson)

2) *Brassica compestris var. Sarson* (sarson)

3) *Brassica compestris var. Toria* (Toria)

4) *Brassica juncea* (Rai, brown mustard)

5) *Brassica napus* (Rape, kali sarson)

6) *Brassica nigra* (kali rai, black mustard)

7) *Sinapis alba* L (White or yellow mustard)

Flour from the yellow mustard (*Sinapis alba*) is used in Europe while brown mustard (*B. Juncea*) used in U.S. and Japan. The mustard seeds are rich in protein. The protein is of excellent nutritional quality, being rich in lysine with adequate amounts of sulphur-containing amino acids-limiting amino acids in most of the cereals and oilseed proteins. The mustard plant mainly the seeds, contain special compound namely glycosinolate. These compounds characterise this flavour of mustard. Health benefit of mustard are, it help to controlling symptoms of asthma. It use prevent gastrointestinal cancer. It helps in weight loss. Its use helps in relief in arthritic and muscle pain. It also help in anti aging and stimulate hair growth.

Local names of mustard in India is Banrasi rai, kale sarson (Hindi, Punjabi), Rai (Gujrat), Sasave (Kanada), Sorisa (Kashmir) Avlu (Telgu), Kaduky (Malayalam)

Mustard can be grown in light to heavy loamy soil. Seeds should be treated with thirum at 3 gm per kg to protect plant from seed diseases. It is sown in sep-oct month. Seeds should be sown maximum of 6 cm depth in soil. Mustard crop mature in about 110 to 140 days. Harvested mustard plant should tied into bundle, keep them in sun for 5-6 days to dry. Threshing can be carried at by beating. An average 400 kg per hector yield can be expected but by pest management and good quality it can be increased up to 1000 kg per hector.

Sinapis alba L. (white or 'yellow mustard), *Brassica nigra* (black mustard) and *Brassica juncea* L. (Brown or oriental mustard). Mustards are functional foods having beneficial physiological effects in humans. *Synapis alba* can be used as a source for a wide range of active components including isothiocyanates, phenolics, dithiolthiones and dietary fibre.

The obtained results showed that the yellow and brown mustard seeds contained a higher amounts of both protein (ranged between 32.48 to 36.37%) and oil contents (ranged from 31.78 to 36.32%). also, they contained an adequate percentages of ash and dietary fiber. Furthermore, the investigated mustard seeds containing a considerable

amount of allyl isothiocyanate, which was a higher amount as three times or more (479 mg/100g WT) in brown mustard seeds than that found in yellow mustard seeds (148 mg/100g WT).

In addition, all indispensable amino acids were found in both yellow and brown mustard seeds in high amounts, which were contained a higher exceptionally contents of aromatic amino acids (Phenylalanine and tyrosine), amino acids-containing sulfur (Methionine and cystine), leucine, valine and lysine. Moreover, yellow and brown mustard seed oils were contained higher amount of erucic acid (23.90-37.89%). Also, considerable amounts of four major unsaturated fatty acids; oleic, linoleic, linolenic and gadoleic acids were present; whereas, oleic acid was the prevalent unsaturated fatty acids, followed by linoleic and linolenic acids.

Alternaria is a genus of Deutromycetes fungi. Alternaria species are known as major plant pathogen. They are also common allergens in humans, growing indoor and causing hay fever or hypersensitivity reaction that some time lead to asthma.

They are normally agent of decay and decomposition. The spores are air born and found in soil and water. They can grow in thick colonies. At least 20% of agricultural spoilage is caused by Alternaria species.

Alternaria Brassicae causes Alternaria blight spot. A. *Alternata* causes early blight of potato, like this so many species of *Alternaria* causes serious diseases in plant. All *Alternaria* are not pathogen but some are saprophytic as well as some are endophytic and few have biocontrol agent against plant species.

Alternaria blight caused by singly or by mixed infection is one of the most widespread and destructive disease of oilseed Brassica in all the continents. These pathogens are necrotrophs. The disease appears as black spot but later on enlarges and develops into prominent round spots with concentric rings. The mycelium of *A.brassicae* is septate, brown to brownish grey in colour. The conidiophor are dark, septate. Conidia are brownish black.

Symptoms of the disease are characterised by formation of spots on leaves, stem and siliquae. A.brassicae and A. Brassicicola can affect host species at all stages of growth including seeds.

Till date chemical management was the only option against the problem. Seed treatment with brassicol or capatofol 4 gm(Chahal and Sekhan 1980, Chahal 1982, Saini

1982) Iprodion 1.25 g (Stovold *et.al*.1987) and Carbendazim 2.5 gm or Mancozeb 2gm of seed eradicate the seed borne infection of A. Brassicae. Mancozeb was the best among all the treatment, resulting in the lowest diaease severity on leaves of mustard (Meena *et. al*. 2004). antagonistic strains of Bio-control agents viz., *Trichoderma harzianum, Trichoderma viride* and *Pseudomonas flourescens* against *Alternaria brassicae* causing Alternaria leaf spot on Indian Mustard (*Brassica juncea*). *Trichoderma harzianum* was recorded to be the most effective among the bio agents under lab conditions.

Bacterial blight caused by *Pseudomonas* attack the leaves of mustard. The successful production of mustard is affected by bacterial leaf spot of crucifers caused by *Xanthomonas campestris var. armoraciae or raphani* which is an emerging bacterial disease.

2) REVIEW OF LITRETURE

Oil seed Brassica also known as rapeseed-mustard (*Brassica spp*.) is the second largest oil seed crop that contributes 32 % of total oil seed production in India. Among the oil seed Brassica, yellow sarson, brown sarson, *toria* are grown for edible oil. Whereas black mustard (*B. Nigra*) is used as condiment and for pickle making, food preserving. Mustard –rapeseed are infected by many pathogen but *Alternaria brassicae* causes leaf blight to cause yield loss.

Sundar K. Shrestha, Lisa Munk and Suresh B. Mathur (2005) studied role of weather on Alternaria leaf blight disease and its effect on yield component of mustard. Leaf blight caused by A. Brassicae is an important diseases of mustard (*B. Juncea*) and rapeseeds (*B.compestris*) observation show that disease cause heavy damage to the crops, yield loss, as a result of early defoliation. Alternaria leaf blight incidence was very low in low temperature, during December to February only few spots are observed in the lower leaves in third week of January, which increased slight in February. Experiment was conducted at two different locations i.e.at Khumaltar and Nawalpur. At Nawalpur, symptom of Alternaria leaf blight was first observed on cotyledonary leaves of a few border plant of yellow sarson during the second week of November. Mustard is grown in all along the length of country. The crop infected by *A. Brassicae* causing leaf blight all over country but the severity of disease is much higher in *Tarai* (Shrestha and

shrestha 1992). That is why the experiment was conducted at Nawalpur. The second experiment site was Khumaltar, which represented the mid hill of the country. The experiment conducted with three popular cultivars clearly show that environmental condition at Nawalpur during two year of experiment favoured the disease development of Alternaria leaf blight.

P.D. Meena, R.P. Awasthi, C. Chattopadhyay, S.T. Kolte, Arvind Kumar (2010) studied on Alternaria blight: achronic disease in rapeseed-mustard. Alternaria blight disease caused by Alternaria brassicae has been reported from all the continents of the world and is one among the important disease of Indian mustard causing up to 47% yield losses (Kolte 1985). Average yield loss in the range of 32-37% due to Alternaria blight have been reported from Nepal (Shrestha *et. al*. 2005). Symptoms are first visible on lower leaves with appearance of black points, which later enlarge to develop in to prominent, round, concentric spots of various sizes, with progress. The disease appears on middle and upper leaves with smaller size spots, when defoliation of lower leaves occurs. Later round black conspicuous spots appear on siliquae and stem. Till date chemical management was the only option against the problem. In many European countries organic agriculture has rapidly been transformed from a farmer's movement to an institutionalised part of agricultural policy. Early sowing (Meena *et. al*. 2002) of well stored clean certified seed after deep ploughing, clean cultivation, timely weeding and maintenance of optimum plant population, avoidance of irrigation at flowering and pod formation stages may help to manage the disease. Mancozeb was the best among all the treatment, resulting in the lowest diaease severity on leaves of mustard (Meena *et. al*. 2004). Iprodian (Rovral) spray has been found effective in checking siliquae infection due to A. Brassicae (Cox et. al 1983). Complete resistance against Alternaria blight is not available in the Brassica gene pool.

H. K. Singh (Nov 2017) published on Alternaria of rapeseed mustard-review.This review shows Alternaria blight caused by *A. Brassicae, A. Brassicicola, A. Raphani*, is one of the most wide spread and destructive disease of oil seed Brassica species in all the continents.*A.Brassicae* is more destructive via grater tissue damage and occur frequently over the other species. In India its first authentic observation was in 1901 on sarson (*B. Compestris var. Sarson*) crop raised at Tirhoot near Pusa, Bihar (Butler 1981). The disease plays havoc with the crop by reducing its photosynthetic

area, growth and seed yield. Besides quantitative loss in yield, quality of seeds i.e. its size, colour and germinability and oil yielding capacity are also affected adversely due to the disease (M.C. Donald 1959, Bandhopadhyay et. al. 1974). As early as in 1836, Berkeley identified the fungus causing blight on Brassicaceae as *A. Brassicae* (Berk.) sacc. By Saccardo (1886). According to Elliott (1971) Alternaria contains fourty four species. Additional species groups are A. Asborescens, A. Brassicicola, A. Porri, A. Radicina group (simmons, 1995, Robert *et. at*. 2000).Alternaria blight of Brassica can be managed by following a variety of practices.

Use of genotype:- Improved commercial variety of rapeseed- mustard in India are resistant to this disease and genotype reported highly tolerant A. Brassicae from other species under artificial condition are *B. Alba, B. Napus*.

Cultural:- The field and its neighbourhood should be cleaned of weeds before taking up sowing operations, rapeseed-mustard are sown by mid-October escape sever attack of Alternaria blight in north India. High fertility doses especially of nitrogen, increase the severity of Alternaria blight in oil seed rape (Stankova 1972, Kumar and Kumar 2006) but Meena *et.al*. (2002) reported decreases in severity with increased the level of nitrogen.

Chemical:- Seed treatment with brassicol or capatofol 4 gm(Chahal and Sekhan 1980, Chahal 1982, Saini 1982) Iprodion 1.25 g (Stovold *et.al*.1987) and Carbendazim 2.5 gm or Mancozeb 2gm of seed eradicate the seed borne infection of A. Brassicae. Though 24 hr. Storage period after their treatment is needed (Kumar and Singh 1986) spray application of copper fungicides reduces the incidence of Alternaria blight of rapeseed and mustard.

Biological:- Till date chemical management was the only option against the problem. However some reports indicate possibility of biological management of the disease. *Streptomyces arabicus* is natural enemy of A. Brassica. Metabolites of *Streptomyces* sp strain TP-A0569 inhibit spore germination and infection of *A.brassicicola* (Aremu *et. al.* 2003). The effect is specific for *A. Brassicicola* other *Alternaria* spp. is not affected.

Community health:- To make the process of disease management more effective, ecological and eco-friendly crop protection programme planning by the community of farmers should be done collectively.

Surbhi Gupta, Nidhi Didwania, Dinesh Singh (2020) proposed work on biological control of mustard blight caused by Alternaria brassicae using plant growth promoting bacteria. Management of blight disease in India mustard is principally dependent up on chemical fungicides. The rigorous use of synthetic fungicides not only degrade the environment byt is also toxic to harmless non-target microbes. These have beenreports of resistance to these fungicides in a population of the *A. Brassicae* pathogen.An eco-friendly approach, like the use biological agent is a much better *Alternaria* to reduce the incidence of blight disease. Plant growth promoting rhizobacteria (PGPR) not only works against pathogen but also induces growth promoting hormones in the crop, hence improving the quality. Apply the Alternative effect for leading plant growth and reduce the blight diseases induced in mustard by acting against A. Brassicae.

Mh. Ehetishan-Haq et.al. may 2017 studied on management of bacterial leaf spot disease of mustard through resistant germplasm. Canola commonly known as sweet mustard is an important oil seed crop of the world. The successful production of mustard is affected by bacterial leaf spot of crucifers caused by *Xanthomonal compestris* is an emerging bacterial disease in Pakistan. The disease management approach through growing resistant germplasm is cost effective practice. Therefore the present research was conducted to find the resistant mustard germplasm against bacterial leaf spot disease.

A.P.Keinath (2016) proposed work on suppression of bacterial blight on mustard green with host plant resistance and Acibenzolar-S-methyl. Bacterial blight caused by *Pseudomonas cannabina pv.alisalensis* attack the leaves of most Brassica vegetables including mustard green *(B. Juncea*). Carolina broadleaf a new mustard cultivar is resistant to bacterial blight where as Florida Broadleaf a common grown cultivar is susceptible. Acibenzolar-S-methyl (Trade name Actigard) has been used to manage bacterial disease caused by *P. Syringe* on a variety of crops. The objective of this study was to evaluate host resistance and Acebenzolar-S-methyl alone and in combination to manage bacterial blight. Three field experiments were done in spring and fall 2011 and fall 2014. In each experiment Acebenzolar-S-methyl was applied twice as a foliar spray, once before and once plant were inoculated, severity of bacterial blight was 81% less on

non treated Florida Broadleaf. Over all host plant resistance was more effective than Acebenzolar-S-methyl for managing bacterial blight on mustard green.

A.S. Rathi, Dhiraj Singh works on integrated management of Alternaria blight and white rust in Indian mustard. Field experiments were conducted at Hisar, Haryana, during 2007-08 and 2008-09 rabi crop seasons to test the efficacy of different bio-agents, plant extract, and fungicides with different combinations as seed treatment and foliar spray against *Alternaria* blight and white rust diseases in Indian mustard (Brassica juncea). Seed treatment with *Trichoderma harzianum* 10 g/kg seed followed by foliar spray of Ridomil MZ 72 WP (metalaxyl 8% + mancozeb 64%) 2 g/ l water after 50-60 days of sowing, significantly reduced the Alternaria leaf and pod blight up to 43.6 and 30.8 per cent, respectively and white rust up to 39.5%. Significant increase in seed yield up to 26.4 per cent was also recorded in this treatment. However, fungicidal seed treatment with Apron 35 SD (metalaxyl 35%) 6 g/Kg seed followed by foliar spray of Ridomil MZ 72 WP 2 g/ l water after 50-60 days of sowing was found most effective in reducing Alternaria leaf and pod blight up to 54.8 an 43.1 per cent, respectively and white rust 64.2 per cent. Significant increase in seed yield up to 37.3 per cent was recorded in this treatment. Seed treatment with Bavistin 50 WP (carbendazim 50%) 2 g/Kg seed followed by foliar spray of Ridomil MZ 72 WP 2 g/ l after 50-60 days of sowing have shown results almost at par with the above treatment. Use of antagonists, particularly *Trichoderma* species has been reported quite effective against different pathogens (Chattopadhyay et al., 2002) particularly as seed treatment followed by fungicidal spray in managing many fungal diseases in various host pathogen combinations (Rashmi Rohila, 2001)

Surabhi Gupta, Nidhi Didwania, Dinesh Singh (published 18 July 2020) studied on biological control of mustard blight caused by *Alternaria brassicae* using plant growth promoting bacteria. The potential of rhizosphere bacteria to use as bio control agents for suppression of the disease. Total of sixteen bacterial isolates were isolated from the rhizosphere of mustard, tomato and brinjal and they were screened for their antagonistic activity against *A. brassicae* in vitro and in vivo conditions. Out of sixteen isolates, two bacterial isolates (B3 and B12) showed maximum inhibition (35 % and 38.6 % respectively) against the pathogen and also displayed high degree of secondary metabolite formation. These two bacterial isolates molecularly characterized as

Pseudomonas fluorescens were further tested in green house and field conditions through seed bacterization treatment for disease suppression. Mustard seeds were treated with the bacterial solution overnight and were sown in pots and fields the next day. It was found that the disease incidence percentage of B3 and B12 was 32 % and 35 % respectively compared to control with 62.8 %.

Rakesh Anil Kumar And AS Rathi (Feb. 2018) works on management of Alternaria blight in India mustard through fungicides under field conditions. Five fungitoxicants viz., mancozeb (0.2%), azoxystrobin (0.05%), propiconazole (0.05%), difenconazole (0.05%) and hexaconazole (0.05%) were tested for their efficacy against Alternaria blight disease alone as single spray at 45 DAS and in combination with mancozeb at 45 DAS followed by spray of other four fungicides individually at 60 DAS under field conditions for two consecutive years during rabi 2015-16 and 2016-17. The spray of different fungitoxicants alone as single spray treatment or each fungicide in succession with mancozeb (0.2%) significantly reduced the Alternaria blight disease over control; however the level of efficacy varied among the treatments. In general, the combinations of two fungicides spray i.e. mancozeb at 45 DAS followed by other four fungicides each at 60 DAS have recorded lower Alternaria blight severity as compared to all single spray treatments. Foliar spray with mancozeb (0.2%) at 45 DAS followed by hexaconazole (0.05%) at 60 DAS was found most effective in controlling Alternaria leaf blight severity up to 78.0 percent and Alternaria pod blight severity up to 56.5 percent and increased seed yield up to 29.9 percent as compared to untreated control.

Kabrabam Suraj Jakson and Adesh Kumar (published 16 May 2019) publish work on Management of Alternaria leaf spot on Indian mustard through chemical and biological agents. Experiments were conducted under in vitro and field conditions to evaluate some commonly known Chemical fungicides viz., Azoxystrobin 23% SC (Amistar), Propiconazole 25% EC (Tilt), Mancozeb 75% (Indofil M-45) and combined formulation of Carbendazim 12% + Mancozeb 63% (Colt) and antagonistic strains of Bio-control agents viz., *Trichoderma harzianum*, *Trichoderma viride* and *Pseudomonas flourescens* against *Alternaria brassicae* causing Alternaria leaf spot on Indian Mustard (*Brassica juncea*) using Bioassay and Dual culture technique respectively. *Trichoderma harzianum* was recorded to be the most effective among the bio agents under lab conditions, inhibiting up to 65.83% of the test pathogen. Tilt proved best in lab

conditions, showing complete inhibition of the test pathogen at all concentrations. Amistar gave best performance among all test chemical fungicides under field conditions with lowest severity of 36.30%, and infection rate 0.0266 unit-days and *T. harzianum* best among the bio agents with record severity of 68.88% infection rate 0.0437 unit-days.

R.S. Netam, S.C. Mukherjee, Salam and P.S. Netam (7 Nov. 11) studied on Management of Alternaria leaf and pod blight diseases of mustard through combination of Bio-agent, Fungicides, Micronutrients, and Cultural operations in Bastar plateau of Chhattisgarh. Nine different treatment combinations of bio-agents, fungicides, micronutrients and cultural operations with a control were testing the effectiveness against the Alternaria leaf and pod blight of mustard in two consecutive crop seasons, 2011-12 and 2012-13. The integrated disease management (IDM) practice is used for reducing Alternaria leaf and pod blight and for sustaining higher yields of mustard. The use of ZnO 15 kg/ha (SA) + Borax 10kg/ha (SA) + Sulphar as basal dose + P. flurescens 10 ml/lit water (FS) against the recorded minimum disease severity and gave highest per cent disease control as compared to other treatments.

3) OBJECTIVE OF RESEARCH

The objective of research to study and evaluate of loss of yield takes place by Alternaria blight and Bacterial blight disease in mustard. This work will be carried out for following aim and objectives.

1] Collection of infected plant materials from Nanded district.

2] Isolation, purification and identification of *Alternaria spp.* causing blight disease in mustard.

3] To study pathogenicity test.

4] To study chemical control of blight disease of mustard.

5] To study biological control of blight disease of mustard.

6] To study biocontrol of blight disease of mustard.

4) MATERIALS AND METHODS

Material and method are used in management of Alternaria blight and bacterial blight of mustard are,

1] Collection of infected plant parts from region of Nanded district.

2] Isolation, purification and identification of different pathogens.

3] Pathogenicity test.

4] Chemical control of leaf Alternaria blight and Bacterial blight disease:-

Effect of different fungicides against Alternaria spp. and *Pseudomonas*.

5] Biological control of leaf Alternaria blight and Bacterial blight disease:-

Effect of different plant extract against Alternaria spp. and *Pseudomonas*.

6] Biocontrol of leaf Alternaria blight and Bacterial blight disease:-

Effect of different biocontrol agents against Alternaria spp. and *Pseudomonas*.

Collection of plant samples: - In this research fungal infected part of mustard will be collected from different area of Nanded district of Marathwada. Fresh infected plant material used for the isolation of fungus. It will be done at Botnay Dept. Of Degloor college Degloor Dist Nanded. Sample collection will be done randomly. Mustard leaf showing typical symptoms will be collected and washed with tap water. Affected parts dried and cut in to pieces.

Isolation: - Potato dextrose Agar (PDA) plate method was comfortable for fungal isolation. Fungal isolation was done by PDA medium. PDA composition was peeled potato 200 gm/1lit, dextrose 20 gm/1lit, and Agar 15 gm/1lit, pH is adjusted by pH meter. PDA was sterilized along with glass wares in autoclave. Test pathogen was transferred aseptically on the PDA slant in test tube. Test tube was stored in refrigerator.

Identification:-Pure culture of test pathogen obtained was inoculated aseptically on autoclaved PDA in Petri dish, and pates are inoculated at 27 $\pm$ 1ºC. A profuse growth of a fungus in plate was observed after one week. Morphological and microscopic characteristics of fully developed test pathogen were studied under lw power as well as high power magnification of microscope.

Pathogenicity test: - Ten days old culture of the organisms was used for proving the pathogenicity. For this seeds of mustard are sown in two earthen pot filled with stem sterilized potting mixture of soil: sand: FYM (2:1:1). Healthy growing seedlings were maintained. Healthy seedlings were selected for inoculation. The spore suspension was prepared by filtrate through muslin cloth and diluted in to with sterile distilled water. The seedlings were inoculated with test fungus. Uninoculated seedlings of the same age

spread with sterilized water. After inoculation pots ware incubated in screen house. Under controlled condition for further development of Alternaria blight symptoms.

Efficacy of fungicides, botanicals and bio agents (*in vitro*):- Efficacy of fungicides like Mancozeb, Azoxystobin, Ropiconzol, Chlorothalonil, Hexaconazole etc were evaluated *in vitro* against *Alternaria* spp caused Alternaria blight in mustard. The plant extract of botanicals like Karanj (*Pongania glabra*), Neem (*A. Indica*), Nirgudi (*Vetex negundo*), Mehandi (*Lawsonia inermis*), Dhotra (*Datura metal*) were evaluated *in vitro* against *Alternaria* spp caused Alternaria blight in mustard. Three fungal antagonists like *Trichoderma harzianum*, *Trichoderma viride*, *Pseudomonas florescens* were evaluated *in vitro* against *Alternaria* spp caused Alternaria blight in mustard.

5) IMPORTANCE OF STUDY

Mustard belonging to family Brassicaceae is an important oil seed crop of the world. It is the world's third most important source of vegetable oils and their production become up word rise during the past 25 years. The crop has great contribution in world's agricultural economy.

India is the third largest country in mustard production after China and Canada with annual production of 7.36 million tonnes from 6.5 million ha area. Indian mustard (*Brassica juncea* (L.)) is one of the major oil seed crop cultivated in India and around the world. Among the various oil seed crops cultivated in India, the mustard is accounted for 25% total area and 1/3 of total oil production in country after ground nut.

Mustard extensively grown traditionally as a pure crop as well as intercrop (mixed crop) in marginal and sub marginal soil in the eastern, northern and north western state of India. India is one of the largest producer of oi seed in the world and backbone of agricultural economy of India. It is accounted for an estimated production of 32.10 MT with 26.21 thousand hector of area and 1224 kg/ha in 2016-17 and production of edible oil was about 7.05 MT. Productivity of mustard is highest (1559 kg/ha) in the state Haryana and lowest (524 kg/ha) in Assam.

Certain biotic and abiotic factor limits the productivity of the crop, among which infection by plant parasitic pathogen disturbs the normal physiological function of the crop during growth and causing major loss in its production. Among the most common

pathogen of mustard is Alternaria leaf blight in *Brassica juncea* is found to be distributed worldwide and most destruction to the crop in India.

6) PROPOSED WORK PLAN

1] 2021	July 21 - Dec. 21	-Course work.
2] 2022	Jan. 22 – Dec 22	-Collection of infected plant sample. -Isolation, purification and identification Alternaria spp. -Pathogenicity test.
3] 2023	Jan. 23 - June.23	- Chemical control of leaf Alternaria blight and Bacterial blight disease:- Effect of different fungicides against Alternaria spp. and *Pseudomonas*.
	July 23 – Dec. 23	- Biological control of leaf Alternaria blight and Bacterial blight disease:- Effect of different plant extract against Alternaria spp. and *Pseudomonas*.
4] 2024	Jan. 24 – June 24	- Biocontrol of leaf Alternaria blight and Bacterial blight disease:-Effect of different biocontrol agents against Alternaria spp. and *Pseudomonas*.
	July 24 on word	-Finalization of obtained result, satisfied analysis and submission of thesis

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